



A.D. 1826 N° 5427.

S P E C I F I C A T I O N

OF

CHARLES PEARSON, JUNIOR, RICHARD
WITTY, AND WILLIAM GILLMAN.

APPLYING HEAT FOR THE GENERATION
OF STEAM.

L O N D O N :

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Applying Heat for the Generation of Steam.

PEARSON, WITTY, AND GILLMAN'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, WILLIAM GILLMAN, of Whitechapel, in the County of Middlesex, Engineer, send greeting.

WHEREAS His most Excellent Majesty King George the Fourth, by
5 His Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, the Thirteenth day of December, in the seventh year of His reign, did, for Himself, His heirs, and successors, give and grant unto me, the said William Gillman, together with Charles Pearson, the younger, of Greenwich, in the County of Kent, Esquire, and Richard Witty, of Hanley,
10 in the County of Stafford, Esquire, our executors, administrators, and assigns, and every of us, His especial licence, that we, the said Charles Pearson, Richard Witty, and William Gillman, our executors, administrators, and assigns, and every of them, by ourselves, or by our deputy or deputies, servants, or agents, or such others as we, the said Charles Pearson, Richard
15 Witty, and William Gillman, our executors, administrators, or assigns, should at any time agree with and no others, from time to time and at all times thereafter during the term of years therein expressed, should and lawfully might make, use, exercise and vend, within that part of the United Kingdom of Great Britain and Ireland, called England, the Dominion of Wales, and
20 the Town of Berwick upon Tweed, our Invention of "**A NEW AND IMPROVED METHOD OR METHODS OF APPLYING HEAT TO CERTAIN USEFUL PURPOSES;**" in which said Letters Patent there is contained a proviso obliging us, the said Charles Pearson, Richard Witty, and William Gillman, particularly to describe and ascertain the nature of our said Invention, and in what manner the same

Pearson, Witty, & Gillman's Improvements in the Application of Steam.

is to be performed, by an instrument in writing under our hands and seals, or under the hand and seal of one of us, and to cause the same to be enrolled in His Majesty's Court of Chancery within six calendar months next and immediately after the date of the said recited Letters Patent, as in and by the same, reference being thereunto had, will more fully and at large appear. 5

NOW KNOW YE, that in compliance with the said proviso, I, the said William Gillman, do hereby declare that the nature of our said Invention, and the manner in which the same is to be performed, is described and ascertained as follows (that is to say):—

Our new or improved method or methods of applying heat to certain useful 10 purposes doth consist in heating water or other fluid to any requisite temperature for its evaporation or conversion into steam of high or low pressure, or for any other purpose, by so directing the heat from a fire by a descending flue, and supplying the water or other fluid at the lower part of the apparatus to ascend by a continuous channel, as nearly as practicable in contact with 15 such flue, so as that the particles of fluid meeting with increasing temperature by passing in an opposite direction to that of the current of heat, may, in proportion as they expand by abstracting that heat, acquire a tendency to rise and be carried forwards towards those parts of of the flue that are hotter, until by the continual accession of heat they arrive at the situation of highest tem- 20 perature; to effect this, we construct the flue or flues in the manner of descending flues, so that the draft from the fire shall be downward until it reach the opening into the chimney or other vent. The boiler or vessel in which the fluid is to be so heated we form into two, three, or more shallow cases or divisions, according to the quantity to be heated, the magnitude of 25 the fire, and other circumstances, observing that the larger the horizontal area and the smaller the depth of each case or division, the more rapidly will the fluid therein be heated); placing the said divisions in teirs one above another, connecting the same so as to make them in communication with each other, alternately downward and upward at opposite ends, and supporting the same 30 on all sides with brickwork or other material, in any manner that will so form the fire-place and the flue or flues, as to cause the current of heat to descend, and in its descent to sweep along both the top and bottom of each of the cases or divisions, or of as many as may be desirable. The fluid to be heated we first introduce by a force or feeding pump or other means, as circumstances 35 may require, into the lowest of the said divisions, which being exposed to that part of the flue where the heat is least or most exhausted, the cold fluid is in the most proper relative state for abstracting the last portion of heat derivable from the current before it quits the flue and enters the chimney. The

Pearson, Witty, & Gillman's Improvements in the Application of Steam.

particles of the fluid, as they warm, rise by expansion or diminished specific gravity, in some degree independently of the pressure of the force or feeding pump, to the upper internal surface of the division, where by means of a sufficient communication, open upward to the next division of the boiler, that
5 portion of the fluid that has attained most heat in the lowest division, ascends with the aid of the force pump or other feeding power to the second division, which being nearer to the fire is capable of transmitting a higher temperature to the fluid than it attained before; and its particles receiving a renewed impulse, rise by a similar communication from the second divi-
10 sion to a third, where, being exposed to still higher temperature, the fluid continues to ascend; and thus, through any number of connected divisions that may be requisite for the object in view, it finally reaches the division most exposed to the heat of the fire, and attains the temperature required for its evaporation or conversion into steam, which may be worked off in the usual
15 way under any pressure duly proportioned to the strength of the boiler. The size and form of the communications are not material, so that they be adequate to the passage of as much water or other fluid as the feeding power may supply; but the situation of the communication downward should be at an opposite or different end from that of the communication upward in each
20 division, so that the fluid entering from below into one end of the division shall traverse the whole length thereof in a contrary direction to the current of the flue before it passes up into the next division.

Another way of applying this principle is by forming with iron or other metal the fire-place and downward alternately reverted flue or flues in one
25 air-tight connection, and placing the same in a boiler or vessel of any required size, form, and material, observing that the area of all the flues so placed should be nearly or entirely the same as that of the boiler at their respective depths or levels when fixed, leaving sufficient space, either at intervals or in continuity, between their rims and the sides of the boiler, for the water or
30 other fluid to rise according to the intended rate of supply at such points only as to insure that the fluid shall traverse the flues in the most opposite direction to the current of the flue practicable. By making one or both of the ends of each course or level of the flue to coincide or come in contact with the corresponding end or side of the boiler, provision may be made for openings
35 for cleansing the flue occasionally, and in like manner it may communicate at bottom with the chimney or vent. Each course or level of the flue or flues being in the aggregate nearly equal in width to that of the boiler, the depth of the flue may be in the smallest proportion compatible with the cleansing of them, and the spaces for the water or other fluid to circulate in between the
40 different courses or levels of the flues should also be shallow. The fire-place

Pearson, Witty, & Gillman's Improvements in the Application of Steam.

and ash-pit may be fitted to the side or front of the boiler at a convenient part, according to the method of making boilers for steam-boats, and should, like them, be kept surrounded with water. For generating what is usually termed high pressure steam, we prefer the tubular to any other description of vessel, and the higher the pressure required, the smaller should 5 the calibre of the tubing. When this method is adopted, we place the tubes horizontally, or nearly so; tiers one above another, as before described, for the divisions of a boiler, making the flue or flues tight with brick and tile or other material proper for fire work, and so as to secure the downward draft in the reverting course requisite to make the heat sweep along each tier of 10 tubes successively. The tubes may themselves, if placed in perfectly close lateral contact, or made in metal plates or blocks, from the flues or the tubes, may be placed at small intervals in the tiers and across the respective courses of the flue or flues, and as high therein as practicable, so as to preserve sufficient depth of flue under them to admit a rake to cleanse the same when 15 necessary. The tubes are respectively connected by short tubes from tier to tier in such a manner as to make a steam-tight communication from one end of each horizontal tube to a tube in the tier below, and from the other end to a tube in the tier above; so that the lower tier of tubes being fitted at one end of them into a service pipe supplied with water or other fluid by a force or 20 feeding pump, or by any adequate pressure, the fluid, warming in its passage through each tube, acquires the tendency to ascend, as already described, and passes up the communication at the other end into the tube in the next tier above, which, being in a higher temperature, furnishes an increase of heat to the water as it passes along to the other end, where it rises again by the 25 connecting tube to the tube in the next tier; and so on, until it attains the requisite heat in the upper or last tier of tubing, boilers, or other vessel, or is suffered to expand in a steam reservoir or case, in which the tubing may terminate. It may be proper to give the horizontal portion of the tubing a slight elevation in the direction of the current of the fluid, and sometimes, 30 particularly in small apparatus, to connect them horizontally, so as to oblige the fluid to flow through two or more tubes or through every tube in each tier before the fluid ascends to the next tier; or a tier may be divided into sections of two or more tubes connected horizontally at each end, and from the tube or connecting piece by which they are so connected at one end a common com- 35 munication may be made with the tier below, and in like manner at the other end with the tier above, and one long tube contorted into a similar shape may be substituted for any portion of the various tubes connected in the manner before described, should it be thought preferable. The method of applying heat in respect to the mode of heating water or other fluid, as above 40

Pearson, Witty, & Gillman's Improvements in the Application of Steam.

described, which we claim as our Invention, being confined to the arrangement by which the water or other fluid is conveyed in its coldest state to the situation that is lowest or most favorable to its abstracting the last available portion of heat from the nearly exhausted gaseous conductors or carriers
 5 thereof, passing downwards from the fire by a contiguous passage, but in an opposite direction; so that, on thus acquiring a tendency to rise, the fluid may be in a situation to ascend, and be carried forward by virtue of the impulse so acquired in the tubing, cases, or divisions, arranged as above directed, for conveying the fluid to warmer and still warmer situations, in the manner already
 10 described, until it acquire the highest temperature practicable or expedient. Whereas in the foregoing description of our Invention or improvements many things are necessarily mentioned that are already known and in use, the application of which, in our method or methods of applying heat, we have pointed out for the illustration thereof, but the materials, forms, connections
 15 and dimensions of which, in all other respects than those we have particularized, are discretionary, and must be varied according to the various purposes for which our methods may be used, being sufficiently known to all competent persons conversant with the apparatus employed for high-pressure steam boiler making and the like, to be adjusted as circumstances may render expedient;
 20 we hereby declare that we do not claim any exclusive right in respect of those things, but only to the employment thereof for the purposes herein set forth, of applying heat by a descending current to warm a fluid ascending contiguously in an opposite direction. And we claim the exclusive right of applying heat from a fire in this method by either of the arrangements or contrivances
 25 herein described, or by any other in imitation thereof.

WILLIAM GILLMAN. (L.S.)

AND BE IT REMEMBERED, that on the Thirteenth day of June, in the year of our Lord One thousand eight hundred and twenty-seven, the aforesaid William Gillman came before our Lord the King in His Chancery, and
 30 acknowledged the Specification aforesaid, and all and everything therein contained, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute in that case made and provided.

Inrolled the same Thirteenth day of June, in the year above written.

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